



PROJECT MUSE®

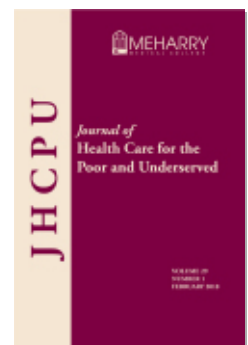
Measuring the Effect of Social Determinants on Patient
Outcomes: A Systematic Literature Review

Andrew J Knighton, Brad Stephenson, Lucy A Savitz

Journal of Health Care for the Poor and Underserved, Volume 29, Number
1, February 2018, pp. 81-106 (Article)

Published by Johns Hopkins University Press

DOI: <https://doi.org/10.1353/hpu.2018.0009>



➔ *For additional information about this article*

<https://muse.jhu.edu/article/686956>

Measuring the Effect of Social Determinants on Patient Outcomes: A Systematic Literature Review

Andrew J Knighton, PhD, CPA

Brad Stephenson

Lucy A Savitz, PhD, MBA

Abstract: Given the movement towards value-based purchasing in the United States, health care leaders need methods to characterize and address the complex effect that social determinants have on health care outcomes. This systematic literature review was specifically designed to understand current research on the effect that patient material and social deprivation has on health care delivery outcomes and the potential benefit of clinical interventions designed to mediate this effect. A total of 310 studies were identified for review with 80 studies included in the final synthesis. Results highlight significant variation in the methods used to measure the effect of social determinants on health care outcomes and the need for common measurement standards. More robust identification of deprivation-sensitive diseases or conditions is needed to channel scarce program resources to effected conditions. Finally, further research is needed to evaluate the benefits of data-driven, tailored clinical interventions designed to serve the needs of materially-deprived patient populations.

Key words: Social determinants of health, population health, health care organizations, material deprivation, delivery systems, socioeconomic status, patient outcomes, quality improvement, evaluation.

Population health follows a social gradient.¹ People who are economically and/or socially less deprived have better health outcomes.^{1,2} Social determinants of health (“social determinants”) are defined by the World Health Organization as “the circumstances in which people are born, grow up, live, work and age, and the systems put in place to deal with illness”^{3 [p.1]} and describe the social, economic and political processes and relationships that can influence key health outcomes.³ People higher on the social gradient generally have more favorable social determinants that affect health.¹ Payer demand for more value-based purchasing of health care that holds health care organizations responsible for health care outcomes increases the need for these organizations to understand how social determinants affect outcomes and population health in the context of health care delivery.

The term deprivation is used in the literature to describe the “disadvantaged position

ANDREW J KNIGHTON, BRAD STEPHENSON, and LUCY A. SAVITZ are all affiliated with the Intermountain Institute for Healthcare Delivery Research, Intermountain Health Care in Salt Lake City, UT. Please address all correspondence to Andrew J Knighton PhD, CPA, Intermountain Institute for Healthcare Delivery Research, Intermountain Healthcare, 36 South State Street, Suite 1600, Salt Lake City, UT 84111; email: andrew.knighton@imail.org.

of an individual, family or group relative to the society in which they belong” [200] and has economic and social dimensions.¹ Material deprivation includes the lack of basic resources for living and is closely related to measures of socio-economic status and poverty.⁴ Social deprivation describes the lack of support provided by other persons.⁵ Material and social deprivation are correlated.⁶⁻⁷ Both forms of deprivation can be measured at either the person or ecologic level and are shown to have independent effects on health.¹ Research suggests that patients who are more materially deprived or that come from more materially deprived neighborhoods have poorer health care outcomes, including increased mortality,⁸ higher emergency department (ED) utilization,⁹ increased readmission risk,¹⁰ delays in time to diagnosis and treatment,¹¹⁻¹² poorer medication adherence,¹³ and less effective engagement in shared decision making.¹⁴

A proposed causal pathway between lower socioeconomic status and poor health care outcomes includes more limited access to care (result: inadequate treatment and increased risk of complications), lower quality of care and poorer self-care behaviors (including diet and exercise).¹⁵ More recent theories point to related issues including patient health literacy¹⁶ or patient activation and engagement¹⁷ as contributing factors. As a result, barriers to receiving equitable care may include limited resources to obtain care, communication difficulty between the patient and the provider and challenges navigating the health care delivery system.¹⁸ The Institute for Healthcare Improvement (IHI),¹⁹ the Institutes of Medicine (IOM),²⁰ the National Academies of Science, Engineering and Medicine (NASEM)⁴ and the Agency for Healthcare Research and Quality (AHRQ)²¹ have each proposed frameworks to characterize these relationships.

The purpose of this study was to characterize the results of recent published research on two critical questions facing health care organizations. First, how does patient or area deprivation modify the effect of standard of care interventions? Second, what targeted or design interventions modify the effect of patient or area deprivation on health care outcomes? Understanding the relationship between material deprivation and health care outcomes can assist health care organizations in designing effective interventions that address the potentially distinct needs of these more vulnerable populations, reduce health care disparities and lower the cost of care delivery.

Methods

A systematic review of the peer-reviewed literature was conducted. Research into health and health care disparities is an extremely broad topic. The Conceptual Framework of Social Risk Factors for Healthcare Use, Outcomes and Cost (“the Framework”) developed by NASEM was the basis for development of the analytic framework for the review as noted in Figure 1.⁴

The PICO (Population, Intervention, Comparator, Outcomes) model for clinical questions was applied based upon the analytic framework presented in Figure 2 to refine the research scope.²²

Evidence supports utilization of the PICO framework to improve searching PubMed and other data bases for clinical questions.²³ Following the PICO model, the following terms were set:

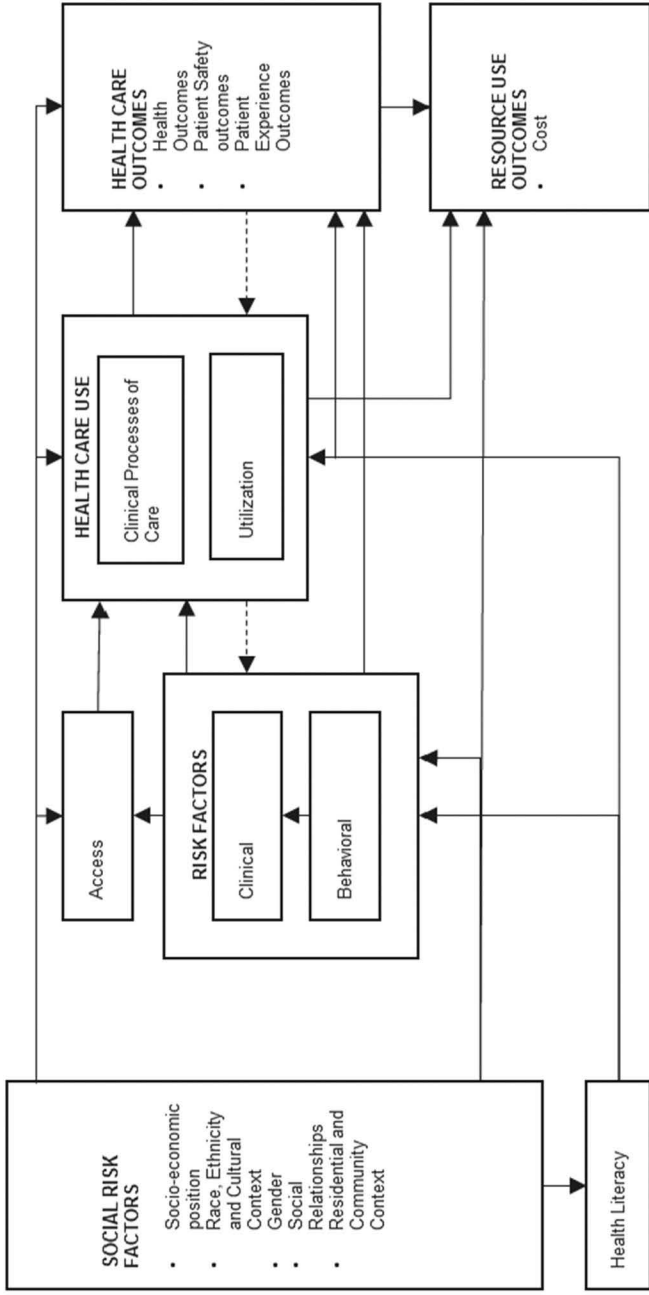
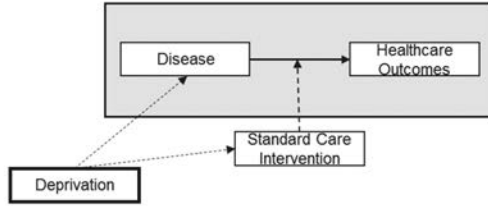


Figure 1. National Academy of Sciences, Engineering, and Medicine (NASEM) conceptual framework for social risk factors for healthcare use, outcomes, and cost.

(A) How does patient or area deprivation modify the effect of standard care interventions in the US and Canada?



(B) What targeted or design interventions may mediate the effect of patient/area deprivation on healthcare outcomes in the US and Canada?

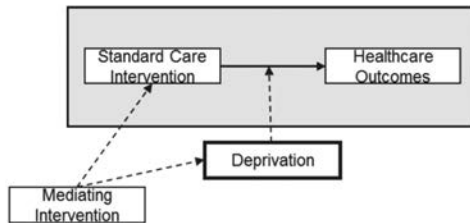


Figure 2. Analytic frameworks for conducting systematic review.

- Population = All U.S. or Canadian patients receiving health care at a delivery system for any disease or condition
- Intervention or exposure = Deprivation or poverty and related clinical interventions
- Comparator = Delivery system interventions designed to mitigate the effect of deprivation on health care outcomes
- Outcomes = Health care outcomes including mortality, morbidity, utilization, cost, patient/clinician behaviors

Based upon this model, the following initial query was developed and run in PubMed in August 2015. A subsequent update to the query was run in May 2016 to capture more recent studies.

[("patient deprivation" OR "area deprivation" OR "neighborhood deprivation" OR "community deprivation" OR "social deprivation" OR "deprivation index" OR "social determinants" OR "socio-economic status" OR "socioeconomic status" OR "poverty" OR "high school education" OR "household income"] AND [("United States" OR "Canada")] AND [("health system" OR "health care" OR "integrated health system" OR "delivery system")]

Despite differences in payment systems, Canadian studies were included given Canada's close geographic proximity to the United States, its similar standard of medical care and the similar challenges faced by both healthcare systems in addressing the needs of underserved populations. Study criteria were limited to systematic reviews, observa-

tional and experimental studies, case reports, and evaluation studies performed in the past 10 years and reported in English in PubMed. Title and abstract screening criteria was used to exclude studies that met the criteria listed in Box 1. The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) model was used to report results as noted in Figure 3.²⁴ Once the final set of peer-reviewed articles was identified, studies were further classified based upon study design type (observational versus experimental), deprivation measure type (by characteristic measured and measurement method used), disease or condition classification, primary study outcomes (classified using the NASEM Framework (Figure 1)), and health care delivery system intervention components.

Consistent with the analytic framework presented in Figure 2, two sets of studies were identified. The first set of studies included observational studies (n=66) that specifically examined the effect modification of deprivation on existing standard of care interventions and related health care outcomes. Patient-level studies assessed the underlying risk factors associated with deprivation, patient behaviors and health care outcomes. Clinician-level studies included understanding the association between patient deprivation and disparities in encounter-level clinician behavior. Characteristics of health care delivery system performance associated with disparities in health care outcomes were also included. Given the frequency of use, studies using insurance status as a proxy for deprivation were included despite limitations using this approach as noted in the Discussion section.

The second set included experimental and quasi-experimental studies (n=14) that identify targeted or design interventions that may mediate the impact of patient or area deprivation on health care outcomes. Health care intervention components included enhanced clinical content, workflow redesign, additional care support, and/or the

Box 1

EXCLUSION CRITERIA FOR ABSTRACT SCREENING

- Patients <18 years of age
- Cohorts from outside the US/Canada
- Limited to discussion of research methods or study protocol
- Limited to examining the association between deprivation and the general incidence or prevalence of a disease in the general population
- Limited to evaluating race-ethnicity only with no measure of social determinants
- Limited to broad structural issues with the broad national or regional health system or the patient environment (home)
- Studies evaluating structural disparities across payer types
- Population-based studies conducted outside a specific health system that examined patient experiences with the healthcare system generally were excluded.
- Specialty-based non-medical care (dentistry, optical, etc.)
- General relevance to the research questions

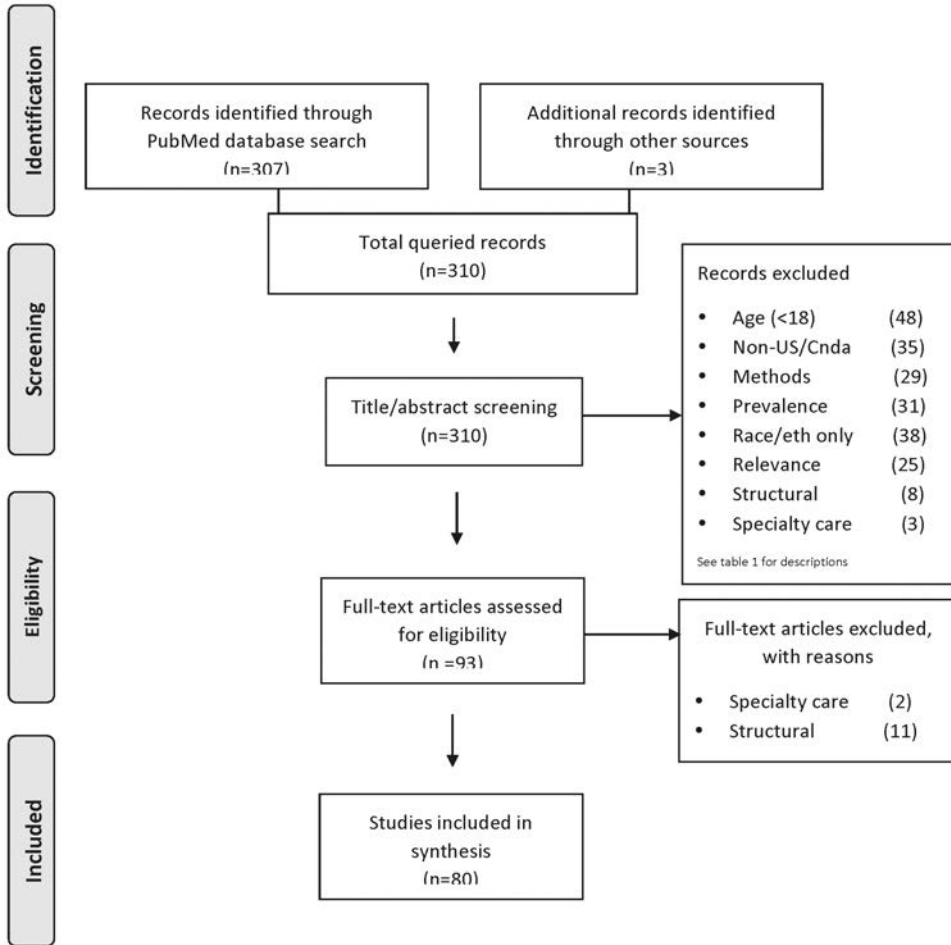


Figure 3. Results of systematic literature review.

introduction of new technologies to enable non-traditional patient and clinician interaction. Within this set, studies were further classified to identify those studies that were performed in a health care setting or with a cohort of patients selected from a health care setting from those performed in the general population. Interventions were also classified based upon phase of treatment (screening/prevention, diagnosis, treatment, monitoring/follow up), location of care (inpatient, ED, primary care) and intervention components (such as evaluation and counseling).

Results

A total of 310 studies were identified for review with 80 studies included in the final synthesis as described in Figure 3. The initial and subsequent queries identified a set of 307 articles for analysis. An additional 3 articles were identified from reviewing references included in the article set. Primary reasons for exclusion of studies after the title/abstract screening included population age (n=48), studies limited to evaluating

race/ethnicity as the primary measure of social determinants (n=38), studies outside the US and Canada (n=35), and studies limited to examining the association between deprivation and the general incidence or prevalence of disease in the general population (n=31). A total of 93 full-text articles were assessed for eligibility. Primary additional exclusions included studies that were limited to broad structural issues with the national or regional system or that evaluated structural disparities across payer type that focused specifically on insurance plan design and access (n=11).

Deprivation measures used in the studies were focused almost exclusively on material deprivation. Only a limited number of studies included elements of social deprivation.²⁵⁻²⁷ Given this, the term material deprivation will be used in describing review results. Meaningful variation existed in the characteristics measured to determine material deprivation status (individual versus neighborhood) and the measurement methods used (individual or person-level, neighborhood-compositional, neighborhood-contextual) noted in Table 1.

Summarizing overall results by frequency of measures used (n=154), 86% of the material deprivation measures used were based upon person-level characteristics involving three distinct methods. Sixty-eight percent (68%) of person-level measures were patient self-reported measures of individual characteristics. The most common individual characteristics included a combination of income, education, payer status, employment status or Federal Poverty Level status of the individual. Twenty-seven percent (27%) of person-level measures involved a neighborhood compositional estimate used to estimate individual deprivation. The most common measures were similar combinations to direct capture of individual characteristics but were averaged at a small-area level and then assigned to patients based upon address of residence. The majority of these small-area methods used measures of the neighborhood boundaries based upon ZIP code followed by census tract. The remaining 5% of person-level measures used neighborhood contextual measures to describe deprivation characteristics of individuals. The most common of these was to use patient admission to a specific hospital located in a particular deprived neighborhood to define the deprivation status of the patient (i.e., the patient was considered materially deprived because they were admitted to a hospital that resides in a neighborhood defined as deprived). The use of neighborhood characteristics to define material deprivation status were used less frequently (14% of total measures used). Three similar measurement methods were used with the frequency more evenly distributed by method as noted in Table 1.

Summarizing results by study (n=80), 50% of studies (39/80) used a single measure of material deprivation—generally income or payer status. The remaining studies used multiple measures with five studies (6%) using some form of composite measure.

Contextually, studies of the impact of material deprivation on patient outcomes varied by disease type as noted in Table 2. Summarizing results by disease or condition studied, cancer was most frequent (36%), followed by cardiovascular (16%), all-cause disease studies (15%), and diseases of the endocrine system (primarily diabetes) (9%).

Classifying observational studies using the NASEM Conceptual Framework, most studies noted significant variation in health care outcomes as material deprivation increased. Material deprivation was associated with access to care/treatment received.^{18,28-30} Material deprivation was negatively associated with patient behavior

Table 1.
MEASURED DEPRIVATION CHARACTERISTICS BY MEASUREMENT METHOD USED

Measured Characteristic	Measurement Method Used				% Total
	Person-level	Neighborhood		Total Measures	
		Compositional	Contextual		
Person-level Characteristics Measured:					
Income	27		18	45	29%
Education	22		6	28	18%
Payer type	19		0	19	12%
Employment status	8		1	9	6%
Federal Poverty Level (FPL)	3		4	7	5%
Admission to specific hospital				7	5%
Race	4			4	3%
Home value/Wealth			3	3	2%
English proficiency	3			3	2%
SES/Not clear			3	3	2%
Migration status/Nativity	2			2	1%
Financial strain	1		1	2	1%
Social support	1			1	1%
Subtotal Individual Characteristics	90	36	7	133	86%
Neighborhood Characteristics Measured:					
Neighborhood poverty	1	2		5	3%
Urban/rural status			2	4	3%
Neighborhood aesthetics	1		1	2	1%
Social support	1		1	2	1%
Neighborhood vigilance	1			1	1%
Neighborhood problems	1			1	1%
Neighborhood violence		1		1	1%
Social cohesion/trust	1			1	1%
Income			1	1	1%
Education			1	1	1%
Access to healthy food				1	1%
Employment		1		1	1%
Subtotal Neighborhood Characteristics	6	6	9	21	14%
Total Measures	96	42	16	154	100%
Percentage Total Measures	62%	27%	10%	100%	
% Subtotal Person-Level Characteristics	68%	27%	5%	100%	
% Subtotal Neighborhood Characteristics	29%	29%	43%	100%	

risk factors that affect health care outcomes including use of preventive care,³¹⁻³⁷ timing of diagnosis and resolution,^{13,27,34, 37-41} demonstration of self-care behaviors (including treatment adherence),^{25,42-43} and disease control.⁴⁴⁻⁴⁵

Studies capturing the effect of material deprivation on the clinical care process including provider or health system behaviors suggest variability in treatment given,^{14,46-58} undertreatment;⁵⁹⁻⁶² delayed treatment;⁶³ higher failure to rescue rates;⁶⁴ effectiveness of clinician communication;¹⁸ and other effects.^{26,65-68} Material deprivation was associated with increased inpatient length of stay;^{54,69-70} increased hospitalizations,⁷¹⁻⁷² higher

inpatient readmissions;⁷³⁻⁷⁴ higher hospital transfer rates;⁷⁵ and other effects.⁷⁶⁻⁷⁷ Study findings included both increases in Emergency Department (ED) visits^{44,78} and no effect.⁷⁹ The effect of deprivation on primary care visits varied by age.^{44,79} All three studies that included costs included lower inpatient costs for materially deprived patients, generally associated with fewer procedures performed and possible undertreatment.^{54,63,66}

Other health care outcomes associated with material deprivation included higher rates of mortality,^{46,50,55,58,63-64,70,80-86} increased complication rates,^{44,64,69} and lower quality of life following care.^{44,87-88}

Examining experimental studies, 14 studies had some form of intervention that either directly or indirectly addressed the potential impact of patient or area material deprivation on health care outcomes. Of these, 13 were conducted within a health care organization or using patient data directly from a health care organization and are listed in Table 3. Nine of 13 studies used person-level measures of material deprivation

Table 2.

SUMMARY OF IN-SCOPE STUDIES BY SYSTEM AND/OR DISEASE TYPE^a

System/Disease	Count	Citation Number ^b
Breast	11	26, 27, 31, 32, 37, 38, 47, 48, 53, 90, 97
Colo-rectal	6	34, 35, 36, 49, 62, 66
Cervical	3	27, 32, 96
Lung	4	50, 55, 81-82
All Types/Other	7	33, 40, 43, 46-47, 64, 88
Total Cancer	31 36%	
Hypertension	3	30, 68, 99
Stroke	3	54, 70, 86
Other	8	51, 57-58, 63, 80, 84, 85, 100
Total Cardiovascular	14 16%	
Not Disease Specific (All-Cause)	13 15%	14, 18, 29-30, 38, 56, 59, 65, 72, 74, 78-79, 101
Endocrine (diabetes)	8 9%	13, 43, 45, 61, 91, 93-95
Other	5 6%	44, 52, 69, 87, 100
Pulmonary	4 5%	25, 39, 71, 73
Mental Health	3 3%	89, 96, 98
Renal	3 3%	42, 76, 83
Immunological	2 2%	31, 91
Pregnancy and Childbirth	1 1%	60
Trauma	2 2%	67, 75
Total	86 100%	

Note:

^aStudies involving >1 disease type are listed multiple times (n=6).

^bPlease refer to list of references at the end of this paper.

Table 3.

STUDIES EXAMINING TARGETED OR DESIGN INTERVENTIONS TO MEDIATE THE IMPACT OF DEPRIVATION ON HEALTHCARE OUTCOMES

Pub Year	First Author/Ref	Title	Purpose	Disease(s)	n	Care Intervention	Phase of Care	Location of Care	Technology	Deprivation Measurement	Primary Outcome	Results	Intervention tailored to specific needs of deprived patients?
2015	Ley N ¹⁶	The Mobile Insulin Titration Intervention (MITI) for insulin adjustment in an urban, low-income population: a randomized controlled trial.	Conduct pilot study using text messaging and phone calls to support patients in achieving optimal insulin glargine dose within 12 weeks	Diabetes	61	Daily request for fasting blood glucose levels, nurse triage calls	Patient monitoring and follow up	Primary care	Text messaging, voice	Self-identified education, income, insurance status	Patient achieves optimal insulin glargine dose in 12 weeks	Effective in helping low-SES patients reach optimal insulin glargine dose	Use of basic text messaging and voice aligns with resources available to low SES patients
2014	Hesler M ¹⁷	Comparison of community health worker-led diabetes medication decision-making support for low-income Latino and African American adults with diabetes using E-health tools versus print educational materials	Compare outcomes between community health worker use of a tailored, interactive, Web-based, tablet computer-delivered tool and use of print educational materials	Diabetes	188	Electronically delivered disease education, risk assessment, current behaviors, goals and actions	Patient treatment	Primary care	Web-based content	Employment status, education, language, income	Changes in patient medication knowledge, patient reported decisional conflicts, satisfaction with information	Improved outcomes in patients using electronic versus print educational materials	Design of education materials tailored to needs of low-income patients
2014	Gablove G ¹⁸	Improving healthcare empowerment through breast cancer patient navigation: a mixed methods evaluation in a safety-net setting	Determine if breast cancer patient navigation improves healthcare empowerment	Breast Cancer	161	Administrative assistance, psychosocial support, education on treatment, support communication	Patient treatment	Hospital	In-person, telephonic	Education, household income, employment, health insurance	Patients' care experience	Effective in improving the patient care experience in a safety net setting	No
2014	Ogudego G ¹⁹	Counseling African Americans to Control Hypertension (CAATCH): Cluster Randomized Clinical Trial Main Effects	Obtain data on implementation of evidence-based multilevel interventions targeted at BP control in hypertensive African Americans who receive care in low-resource primary care practices.	Hypertension	1039	Patient education, home BP monitoring, lifestyle counseling	Patient treatment	Primary care	Web-based content, telephonic	Employment status, education, income, insurance status	Hypertension control	Did not lead to improved hypertension control	No
2014	Shah R ²⁰	The effect of targeted and tailored patient depression engagement interventions on the risk reduction of suicidal thoughts: a randomized control trial.	Determine whether a targeted depression public service announcement (PSA) or an individually-tailored reminder message intervention increases patient discussion of suicidal thoughts with PCP	Depression	867	PSA, tailored IMCP or control	Patient diagnosis	Primary care	Computer-based intervention	Income, education level	Clinician reported discussion of suicidal thoughts	Increased patient engagement in depression care	PSA intervention design was segmented by income level
2013	Miller SM ²¹	Tailored telephone counseling to improve adherence to follow-up regimens after an abnormal pap smear among minority, underserved women	Impact of a tailored telephone counseling intervention on increasing follow-up adherence after an abnormal Pap smear result among low-income, minority women	Cervical cancer	211	Telephone reminder and banners tailored telephone counseling or (2) tailored barriers brochure or (3) nothing	Patient diagnosis	Hospital outpatient	Telephonic	Education, race, employment status	Adherence rate	Improved colposcopy rates among low-income, minority women	Tailored phone counseling and print materials designed to address needs of low income, minority women

Table 3. (continued)

Pub. Year	First Author/ Ref	Title	Purpose	Disease(s)	n	Care Intervention	Phase of Care	Location of Care	Technology	Deprivation Measurement	Primary Outcome	Results	Intervention tailored to specific needs of deprived patients?
2013	Gilman SE ⁴⁸	Economic inequalities in the effectiveness of a primary care intervention for depression and suicidal ideation	Determine if economic disadvantage reduces the effectiveness of depression treatments received in primary care	Depression	514	Depression care manager promotes guideline based treatment, follow up	Patient treatment	Primary care	In-person, Telephonic	Census tract poverty, financial strain, education	Usual care / intervention	Depression moderated the effectiveness of the intervention	No
2013	Rastoin JD ⁴⁹	Use of web-based shared medical records among patients with HIV.	Compare use of shared electronic medical records barriers by HIV patients with HIV	HIV	7388	New medical results, use secure messaging, request appointment, tests	Patient monitoring and follow up	Delivery systems	Web-based content	Neighborhood SES (income, education)	Utilization of specific HIT functionality	Low utilization among HIV patients living in low-SES neighborhoods	No
2010	Bastan R ⁴⁶	Low-income women with abnormal breast findings: results of a randomized trial to increase rates of diagnostic resolution.	Assess effectiveness of a navigation intervention in increasing timely diagnostic resolution of breast findings among indigent women	Breast cancer	1871	Patient education, navigation, address barriers to care, identify community resources delivered by professional health worker (PHW) or PHW and lay health worker.	Patient diagnosis	Hospital outpatient	Telephonic	Mile to a county hospital for care in urban LA	Timely diagnostic resolution of abnormal breast	Did not lead to more timely diagnostic resolution.	Navigation support specific to the needs of indigent women
2010	Et N ⁴⁵	Collaborative depression treatment in older and younger adults with physical illness: pooled comparative analysis of three randomized clinical trials.	Compare the effectiveness of collaborative depression treatment in older and younger adults with physical illness	Depression and other physical illness (stroke, diabetes, other co-morbid illness)	1,081	Education pamphlets, listing of community care resources.	Patient treatment	Primary care	Telephonic	Income	Depression, status, functional outcomes, utilization including low-income, minority patients	Effective in reducing depression in older patients versus younger patients, including low-income, minority patients	No
2008	Waller EA ⁴⁷	Telephone intervention to promote diabetic retinopathy screening among the urban poor.	Compare effectiveness of a tailored telephone intervention to promote retinopathy screening compared to standard print intervention	Diabetes	41	Assess readiness, choices and barriers to screening	Patient screening/ presentation	Primary care	Telephonic	Receiving care at one of three hospitals in low-income neighborhoods	Documentation of diabetic retinopathy screen within 6 months of re-orientation	Significant increase in number of diabetic retinopathy screening exams during 6 months	Telephone intervention designed to meet needs of urban poor
2007	Berra K ⁴⁰	Implementing cardiac risk-factor case management lessons learned in a county health system.	Introduce cardiovascular risk reduction case management program (HeartB Heart)	Coronary heart disease	519	Nurse and dietitian home visits	Patient follow up	Primary care	In-person home visit	Income	Fracturing risk	Lowered risk for CVD versus usual primary care - strategies needed for low income populations	No
2007	Wright K ⁴¹	The AD-LIFE trial: working to integrate medical and psychosocial care management modes.	Conduct pilot study that integrates medical and social care for patients with chronic diseases	Chronic illness	118	Care manager interaction	Patient monitoring and follow up	Hospital		Payer status	Utilization, cost	High patient satisfaction and improvements in health along with reduced readmissions	Design of psycho-social care models

Table 4.
FREQUENCY OF SERVICE COMPONENTS USED IN INTERVENTIONS (N=13 STUDIES)

Service components	Frequency Counts	Citation number ^b
Disease education	9	89–90, 93, 95, 97–101
Evaluation/Assessment	7	90–91, 93–94, 96, 100–101
Counseling/emotional support	6	91, 96–97, 99–101
Navigate health system	4	90, 92, 100, 101
Ongoing Disease Monitoring/Reporting	3	92, 94, 99
Alert/Reminder	2	96, 98
Identify community resources	2	90, 95
Support physician communication	2	89, 97
Treatment planning	1	93
Administrative support	1	97
Mean components utilized per study	2	

Note:

^aSome studies may have multiple components.

^bPlease refer to list of references at the end of this paper.

(income, education, employment, insurance status). The remaining studies used either neighborhood compositional,⁸⁹ neighborhood contextual factors,^{90–91} or a combination of individual and neighborhood composite factors⁹² to estimate person-level material deprivation status. The most common diseases/conditions studied included diabetes (4),^{91,93–95} cancer (4),^{90,95–97} and depression (3).^{89,96,98} The studies covered most aspects of the health care process including disease prevention,⁹¹ diagnosis,^{90,96,98} treatment,^{89,93,95,97,99} and patient monitoring and follow up.^{92,94,100,101} The most common enhanced service elements included patient education, evaluation and counseling as noted in Table 4. Services were delivered on-line, telephonically or in-person.

Of the 13 intervention studies, seven included interventions with specifically adapted intervention components directly designed to address the needs of more materially deprived patients. These interventions considered assumptions regarding the underlying characteristics of materially deprived patients and how they would interact with the health care delivery system including access to telephonic/data resources,⁹⁴ design and content of education materials,⁹³ and tailored counseling⁹⁶ that addressed specific needs of more materially deprived patients. Six of these studies found improvements in patient outcomes following the introduction of an intervention including increased patient engagement,⁹⁸ improved regimen adherence,^{91,96} improved disease control,⁹⁴ improved patient outcomes⁹³ and increased patient satisfaction.¹⁰¹ The remaining intervention study found no improvement following intervention in timely diagnostic resolution among indigent women.⁹⁰ No interventions were designed to provide information on patient material deprivation status that could inform clinicians directly at the point of care.

Discussion

A growing body of evidence points to a correlation between patient material deprivation and health care disparities. However, questions remain. Under what conditions does material deprivation affect the health care experience and health care outcomes? Does it vary by disease? How do patient versus neighborhood-level measurement methods influence results? When should health care delivery systems tailor care to the needs of materially deprived patients? What interventions are most effective in reducing disparities in care? Studies on interventions specifically designed to mediate the impact of material deprivation were limited overall and by specific contexts, including patient- or neighborhood-level characteristics, disease or condition type, phase of the care process, place of service and the intervention components.

Measuring patient material deprivation. Proper identification of materially deprived patients is an important first step in efforts to measure the true scope of disparities in health care outcomes and to evaluate delivery interventions. Two distinct groups of material deprivation measures emerged from this review—person- and neighborhood-level measures—that were often used interchangeably. More precisely, measurements of individual deprivation status are designed to measure an individual patient's circumstances using patient self-reported measures including income, education level and employment status. Such measures are linked to health and health care outcomes by measuring patient capacity. Neighborhood or small-area measures are designed to characterize at a more macro-level the circumstances in which the patient lives, including contextual factors that influence health and health care outcomes. Local environmental economic and social conditions have been linked to general health outcomes through the interaction of individuals with their local community.¹⁰²⁻¹⁰⁷

Traditional measures of person-level material deprivation including race and insurance status remain common due to data availability but are increasingly problematic as measures of material deprivation. Race is a complex construct with potential to characterize both genetic and social elements.¹⁰⁸ While race has been historically linked to material deprivation in certain populations, evidence of health disparities in poorer white populations is increasing.¹⁰⁹ Asian Americans males now have the highest median income of any racial group.¹¹⁰ As a measure of deprivation, insurance status is transitory in nature. Eligibility requirements for Medicaid patients are also highly specific, limiting identification of deprivation within certain populations, including adult males, non-child bearing women and the elderly.¹¹¹ Other common measures including education, income and occupational status have strengths and weaknesses.¹¹²⁻¹¹³

More recent developments in the United States include the introduction of deprivation indices common in Western European countries, designed to provide a geographic based view of material and social deprivation experiences by neighborhood. These composite measures include a combination of several risk factors associated with population characteristics such as mortality or morbidity.¹¹⁴ When used, considerable variation exists in the geographic breakdown of these index measures. Neighborhood units of measure in these studies included counties, ZIP codes, U.S. census tracts and block groups as well as urban/rural designations. The most common measure used was ZIP code, which is an artificial construct developed by the U.S. Postal System

to efficiently deliver mail and has little association with actual neighborhood-level interaction. Census tract small areas approximate neighborhood constructs better than ZIP code.¹¹⁵⁻¹¹⁶

Local and national standardization of a common set of measures and measurement methods designed to identify both materially and socially deprived patients for planning, research or clinical care within a health care setting is needed. Some researchers have argued for the use of multiple measures of socio-economic status in research with the selection of specific measures linked to the appropriate health care outcomes.¹¹²⁻¹¹³ Multi-level measures of deprivation status that incorporate both person-level and neighborhood-level characteristics into a single, two-dimensional bundled measure should be evaluated. Capturing the bundled components separately would support analysis into the relative weighting of person-level and neighborhood-level deprivation status on health care outcomes. A more robust set of characteristics that include social support elements as well would improve understanding of the underlying mechanisms promoting disparities in care.¹⁰⁷

Material deprivation and health care outcomes by disease. A proposed causal pathway between lower socioeconomic status and poor health care outcomes includes poorer access to care (result: inadequate treatment and increased risk of complications), lower quality of care and poorer self-care behaviors (including diet, exercise).¹⁵ This is reflected in the more recent NASEM Framework included in Figure 1.

More recent theories are examining inequities in patient outcomes through understanding underlying variation in the burden of disease on similar patients. Patient burden of disease varies by individual patient characteristics including patient living circumstances, capacity and resilience.¹¹⁷ As a result, health care outcomes for a similar disease of similar severity may vary by person. Using this theory, high-burden diseases requiring regular access to care or a high level of self-care, for example, to maintain disease control, may disproportionately affect deprived patients leading to poorer health care outcomes for these groups. The concentration of studies in this systematic review in patients with cancer, heart disease, diabetes, mental health and other chronic conditions suggests that material deprivation may produce greater disparity in health care outcomes in diseases with a high burden that require regular care access, self-efficacy, activation and engagement.

Identification of potentially deprivation-sensitive diseases or conditions, including the relative impact of specific diseases or conditions on health care outcomes, could assist delivery systems in the design and development of disease-specific pathways that address the potentially distinct health care needs and available social supports of deprived patients with specific diseases. Other contextual factors that may influence the effect of patient material deprivation on health care outcomes should be evaluated.

Mediating the effect of material deprivation on health care outcomes. The initial studies identified through this systematic review highlight the potential positive impact that certain interventions can have on health care outcomes for materially deprived patients by addressing patient resource, communication and navigation barriers. Research into the effect of material deprivation on health care outcomes is highly contextual. Future studies should examine intervention effects in light of disease or condition type, the phase of the care process and the accessibility of technology

and so forth. Potentially generalizable elements of any intervention including patient counseling, education, alert and monitoring, and communication, should be tailored by contextual factors.

Introduction of lay support resources present one interesting and potentially cost-effective approach to addressing the needs of materially deprived patients.^{90,118} Evidence suggests that material deprivation is linked to increased social isolation that can have negative effects on health outcomes.^{7,119} Interventions designed to mitigate the effects of isolation have potential to improve health care outcomes.¹²⁰ The presence of informal social supports including extended family, neighborhood and community resources are positively associated with better health care outcomes and present an important avenue for further study.¹²¹

It is worth noting the role of technology as a delivery mechanism for addressing shortcomings in more traditional in-person interactions between clinicians and patients. The underlying enabler for patient-clinician interaction in the majority of these solutions is communications technology which, given its relative ease of use, low cost and ubiquitous nature, has the potential to deliver health care solutions that transcend socio-economic class.¹²² Communications technology also has the potential to reduce social isolation.

Conclusion and future research. Health services research regarding the impact of deprivation on health care outcomes is fragmented with limited interventions in place. Identifying a measure of social determinants that applies across diverse settlement patterns and is readily available holds promise to address unmet measurement needs in evaluating impact of social determinants on effective treatment, quality improvement and value-based purchasing. There is a need to expand studies beyond select chronic conditions and to establish clear associations between deprivation and patient outcomes by disease type or condition, perhaps leading to the identification of deprivation-sensitive diseases most affected by patient deprivation. Similar work is needed to examine other contextual effects. More research is needed to examine the effect of deprivation in the context of care delivery including understanding and testing interventions specifically designed to mediate the impact of deprivation on health care outcomes for these more vulnerable populations.

References

1. Marmot M, Wilkinson RG, eds. *Social Determinants of Health*, 2nd Ed. United Kingdom: Oxford University Press, 2006.
2. Adler NE, Ostrove JM. Socioeconomic status and health: what we know and what we don't. *Ann N Y Acad Sci*. 1999;896:3-15. PMID: 10681884
3. World Health Organization. *Social determinants of health*. Geneva, SUI: World Health Organization, 2017. Available at: www.who.int/social_determinants/thecommission/finalreport/key_concepts/en/.
4. National Academies of Sciences, Engineering and Medicine. *Accounting for social risk factors in Medicare payment: identifying social risk factors*. Washington, DC: The National Academies Press, 2016.
5. Cohen S, Syme SI. *Social support and health*. London, UK: Academic Press, 1985.

6. Wilkinson RG. *Unhealthy societies: the afflictions of inequality*. London, UK: Routledge, 1996.
7. Pantell M, Rehkopf D, Jutte D, et al. Social isolation: a predictor of mortality comparable to traditional clinical risk factors. *Am J Public Health*. 2013 Nov;103(11):2056–62. <https://doi.org/10.2105/AJPH.2013.301261>
PMid: 24028260
8. Kim JH, Jeong MH, Park IH, et al. The association of socio-economic status with three-year clinical outcomes in patients with AMI who underwent percutaneous coronary intervention. *J Korean Med Sci*. 2014 Apr; 29(4):536–43. <https://doi.org/10.3346/jkms.2014.29.4.536>
PMid: 24753701
9. Kind AJ, Jencks S, Brock J, et al. Neighborhood socio-economic disadvantage and 30-day re-hospitalization: a retrospective cohort study. *Ann Intern Med*. 2014 Dec 2;161(11):765–74. <https://doi.org/10.7326/M13-2946>
PMid: 25437404
10. Tozer AP, Belanger P, Moore K, Caudle J. Socioeconomic status of emergency department users in Ontario, 2003–2009. *CJEM*. 2014 May;16(3):220–5. <https://doi.org/10.2310/8000.2013.131048>
PMid: 24852585
11. Gatrell A, Garnett S, Rigby J, et al. Uptake of screening for breast cancer in south Lancashire. *Public Health*. 1998 Sep;112(5):297–301. <https://doi.org/10.1038/sj.ph.1900492>
PMid: 9807924
12. Dialla PO, Arveaux P, Ouedraogo S, et al. Age-related socio-economic and geographic disparities in breast cancer stage at diagnosis: a population-based study. *Eur J Pub Health*. 2015 Dec;25(6):966–72. <https://doi.org/10.1093/eurpub/ckv049>
PMid: 25829506
13. Parada H Jr, Horton LA, Cherrington A, et al. Correlates of medication nonadherence among Latinos with type 2 diabetes. *Diabetes Educ*. 2012 Jul–Aug;38(4):552–61. <https://doi.org/10.1177/0145721712445215>
PMid: 22546741
14. Ochroch EA, Troxel AB, Frogel JK, et al. The influence of race and socioeconomic factors on patient acceptance of perioperative epidural analgesia. *Anesth Analg*. 2007 Dec;105(6):1787–92, table of contents. <https://doi.org/10.1213/01.ane.0000290339.76513.e3>
PMid: 18042884
15. Kington RS, Smith JP. Socioeconomic status and racial and ethnic differences in functional status associated with chronic diseases. *Am J Public Health*. 1997 May;87(5):805–10. <https://doi.org/10.2105/AJPH.87.5.805>
PMid: 9184510
16. Berkman ND, Sheridan SL, Donahue KE, et al. Health literacy interventions and outcomes: an updated systematic review. *Evid Rep Technol Assess*. 2011 Mar;(199):1–941. PMid: 23126607
17. Hibbard JH, Greene J. What the evidence shows about patient activation: better health outcomes and care experiences; fewer data on costs. *Health Aff (Millwood)*. 2013 Feb;32(2):207–14.

- <https://doi.org/10.1377/hlthaff.2012.1061>
PMid: 23381511
18. Loignon C, Hudon C, Goulet Á, et al. Perceived barriers to health care for persons living in poverty in Quebec, Canada: the EQUIhealThY project. *Int J Equity Health*. 2015 Jan 17;14:4.
<https://doi.org/10.1186/s12939-015-0135-5>
PMid: 25596816
 19. Wyatt R, Laderman M, Botwinick L, Mate K, Whittington J. *Achieving health equity: a guide for health care organizations*. Cambridge, MA: Institute for health care Improvement, 2016. Available at: <http://www.ihl.org/resources/Pages/IHIWhitePapers/Achieving-Health-Equity.aspx>.
 20. Institute of Medicine. *Capturing social and behavioral domains and measures in electronic health records: phase 2*. Washington, DC: The National Academies Press, 2015 Jan.
<https://doi.org/10.17226/18951>
PMid: 25590118
 21. Kaplan R, Spittel M, David D (Eds). *Population health: behavioral and social science insights (No. 15-0002)*. Rockville, MD: Agency for Health care Research and Quality and Office of Behavioral and Social Sciences Research, National Institutes of Health; July 2015. Available at: <https://www.ahrq.gov/sites/default/files/publications/files/population-health.pdf>.
 22. Richardson WS, Wilson MC, Nishikawa J, et al. The well-built clinical question: a key to evidence-based decisions. *ACP J Club*. 1995 Nov–Dec;123(3):A12–3.
PMid: 7582737
 23. Schardt C, Adams MB, Owens T, et al. Utilization of the PICO framework to improve searching PubMed for clinical questions. *BMC Med Inform Decis Mak*. 2007 Jun 15;7:16
<https://doi.org/10.1186/1472-6947-7-16>
PMid: 17573961
 24. Moher D, Liberati A, Tetzlaff J, et al. Preferred reporting items for systematic reviews and meta-analyses: the PRISMA statement. *PLoS Med*. 2009 Jul 21 ;6(6):e1000097.
<https://doi.org/10.1371/journal.pmed1000097>
PMid: 19621072
 25. Kendzor DE, Businelle MS, Mazas CA, et al. Pathways between socioeconomic status and modifiable risk factors among African American smokers. *J Behav Med*. 2009 Dec;32(6):545–57.
<https://doi.org/10.1007/s10865-009-9226-3>
PMid: 19757014
 26. Kong AL, Yen TW, Pezzin LE, et al. Socioeconomic and racial differences in treatment for breast cancer at a low-volume hospital. *Ann Surg Oncol*. 2011 Oct;18(11):3220–7.
<https://doi.org/10.1245/s10434-011-2001-z>
PMid: 21861226
 27. Plascak JJ, Llanos AA, Pennell ML, et al. Neighborhood factors associated with time to resolution following an abnormal breast or cervical cancer screening test. *Cancer Epidemiol Biomarkers Prev*. 2014 Dec;23(12):2819–28.
<https://doi.org/10.1158/1055-9965.EPI-14-0348>
PMid: 25205516
 28. Blanchard J, Ogle K, Thomas O, et al. Access to appointments based on insurance status in Washington, DC. *J Health Care Poor Underserved*. 2008 Aug;19(3):687–96.

- PMid: 18677065
<https://doi.org/10.1353/hpu.0.0036>.
29. Krajewski SA, Hameed SM, Smink DS, et al. Access to emergency operative care: a comparative study between the Canadian and American health care systems. *Surgery*. 2009 Aug;146(2):300–7.
<https://doi.org/10.1016/j.surg.2009.04.005>
PMid: 19628089
 30. Lebrun LA, Shi L. Nativity status and access to care in Canada and the U.S.: factoring in the roles of race/ethnicity and socioeconomic status. *J Health Care Poor Under-served*. 2011 Aug;22(3):1075–100.
<https://doi.org/10.1353/hpu.2011.0075>
PMid: 21841297
 31. Sabatino SA, Coates RJ, Uhler RJ et al. Disparities in mammography use among US women aged 40–64 years, by race, ethnicity, income, and health insurance status, 1993 and 2005. *Med Care*. 2008 Jul;46(7):692–700.
<https://doi.org/10.1097/MLR.0b013e31817893b1>
PMid: 18580388
 32. Liu SY, Clark MA. Breast and cervical cancer screening practices among disabled women aged 40–75: does quality of the experience matter? *J Womens Health (Larchmt)*. 2008 Oct;17(8):1321–9.
<https://doi.org/10.1089/jwh.2007.0591>
PMid: 18788985
 33. Yazdany J, Tonner C, Trupin L, et al. Provision of preventive health care in systemic lupus erythematosus: data from a large observational cohort study. *Arthritis Res Ther*. 2010;12(3):R84.
<https://doi.org/10.1186/ar3011>
PMid: 20462444
 34. Halpern MT, Pavluck AL, Ko CY, Ward EM. Factors associated with colon cancer stage at diagnosis. *Dig Dis Sci*. 2009 Dec;54(12):2680–93.
<https://doi.org/10.1007/s10620-008-0669-0>
PMid : 19117126
 35. Pruitt SL, Leonard T, Zhang S, et al. Physicians, clinics, and neighborhoods: multiple levels of influence on colorectal cancer screening. *Cancer Epidemiol Biomarkers Prev*. 2014 Jul;23(7):1346–55.
<https://doi.org/10.1158/1055-9965.EPI-13-1130>
PMid: 24732630
 36. Strong C, Ji CS, Liang W, et al. Heterogeneous demographic and cultural profiles of Chinese American patients nonadherent to colorectal cancer screening: a latent class analysis. *Cancer Nurs*. 2014 Mar–Apr;37(2):106–13.
<https://doi.org/10.1097/NCC.0b013e3182888b5b>
PMid: 23519040
 37. Tian N, Goovaerts P, Zhan FB, et al. Identifying risk factors for disparities in breast cancer mortality among African-American and Hispanic women. *Womens Health Issues*. 2012 May–Jun;22(3):e267–76.
<https://doi.org/10.1016/j.whi.2011.11.007>
PMid: 22265181
 38. Cobaugh DJ, Angner E, Kiefe CI, et al. Effect of racial differences on ability to afford prescription medications. *Am J Health Syst Pharm*. 2008 Nov 15;65(22):2137–43.

- <https://doi.org/10.2146/ajhp080062>
PMid: 18997143
39. Patel MR, Valerio MA, Janevic MR, et al. Long-term effects of negotiated treatment plans on self-management behaviors and satisfaction with care among women with asthma. *J Asthma*. 2013 Feb;50(1):82–9.
<https://doi.org/10.3109/02770903.2012.743151>
PMid: 23189924
 40. Krok-Schoen JL, Kurta ML, Weier RC, et al. Clinic type and patient characteristics affecting time to resolution after an abnormal cancer-screening exam. *Cancer Epidemiol Biomarkers Prev*. 2015 Jan;24(1):162–8.
<https://doi.org/10.1158/1055-9965.EPI-14-0692>
PMid: 25312997
 41. Porten SP, Richardson DA, Odisho AY, et al. Disproportionate presentation of high risk prostate cancer in a safety net health system. *J Urol*. 2010 Nov;184(5):1931–6.
<https://doi.org/10.1016/j.juro.2010.06.116>
PMid: 20846693
 42. Li Y, Cai X, Glance LG, et al. Gender differences in health care-seeking behavior for urinary incontinence and the impact of socioeconomic status: a study of the Medicare managed care population. *Med Care*. 2007 Nov;45(11):1116–22.
<https://doi.org/10.1097/MLR.0b013e31812da820>
PMid: 18049354
 43. Smalls BL, Gregory CM, Zoller JS, et al. Effect of neighborhood factors on diabetes self-care behaviors in adults with type 2 diabetes. *Diabetes Res Clin Pract*. 2014 Dec;106(3):435–42.
<https://doi.org/10.1016/j.diabres.2014.09.029>
PMid: 25451904
 44. Begley C, Basu R, Lairson D, et al. Socioeconomic status, health care use, and outcomes: persistence of disparities over time. *Epilepsia*. 2011 May;52(5):957–64.
<https://doi.org/10.1111/j.1528-1167.2010.02968.x>
PMid: 21320113
 45. Chew LD, Schillinger D, Maynard C, et al. Glycemic and lipid control among patients with diabetes at six U.S. public hospitals. *J Health Care Poor Underserved*. 2008 Nov;19(4):1060–75.
<https://doi.org/10.1353/hpu.0.0079>
PMid: 19029737
 46. Subramanian S, Chen A. Treatment patterns and survival among low-income Medicaid patients with head and neck cancer. *JAMA Otolaryngol Head Neck Surg*. 2013 May;139(5):489–95.
<https://doi.org/10.1001/jamaoto.2013.2549>
PMid: 23598992
 47. Esnaola NF, Knott K, Finney C, Gebregziabher M, Ford ME. Urban/rural residence moderates effect of race on receipt of surgery in patients with nonmetastatic breast cancer: a report from the South Carolina central cancer registry. *Ann Surg Oncol*. 2008 Jul;15(7):1828–36.
<https://doi.org/10.1245/s10434-008-9898-x>
PMid: 18398659
 48. Gorey K, Luginaahb IN, Hamm C, et al. Breast cancer care in Canada and the United States: ecological comparisons of extremely impoverished and affluent urban neighborhoods. *Health Place*. 2010 Jan;16(1):156–63.

- <https://doi.org/10.1016/j.healthplace.2009.09.011>
PMid: 19840902
49. Foley KL, Tooze JA, Klepin HD, et al. Adjuvant chemotherapy among Medicaid-enrolled patients diagnosed with nonmetastatic colon cancer. *Am J Clin Oncol*. 2011 Apr;34(2):120–4.
<https://doi.org/10.1097/COC.0b013e3181d2ed93>
PMid: 21499198
 50. Yorio JT, Yan J, Xie Y, et al. Socioeconomic disparities in lung cancer treatment and outcomes persist within a single academic medical center. *Clin Lung Cancer*. 2012 Nov;13(6):448–57.
<https://doi.org/10.1016/j.clcc.2012.03.002>
PMid: 22512997
 51. Gaglia MA Jr, Torguson R, Xue Z, et al. Insurance type influences the use of drug-eluting stents. *JACC Cardiovasc Interv*. 2010 Jul;3(7):773–9.
<https://doi.org/10.1016/j.jcin.2010.04.011>
PMid: 20650440
 52. Holman KH, Henke PK, Dimick JB, et al. Racial disparities in the use of revascularization before leg amputation in Medicare patients. *J Vasc Surg*. 2011 Aug;54(2):420–6, 426.e1.
<https://doi.org/10.1016/j.jvs.2011.02.035>
PMid: 21571495
 53. Hess C, Lee A, Fish K, et al. Socioeconomic and racial disparities in the selection of chest wall boost radiation therapy in Californian women after mastectomy. *Clin Breast Cancer*. 2015 Jun;15(3):212–8.
<https://doi.org/10.1016/j.clbc.2014.11.007>
PMid: 25499694
 54. Agarwal S, Menon V, Jaber WA. Outcomes after acute ischemic stroke in the United States: does residential ZIP code matter? *J Am Heart Assoc*. 2015 Mar 15;4(3):e001629.
<https://doi.org/10.1161/JAHA.114.001629>
PMid: 25773298
 55. Bradley CJ, Dahman B, Given CW. Treatment and survival differences in older Medicare patients with lung cancer as compared with those who are dually eligible for Medicare and Medicaid. *J Clin Oncol*. 2008 Nov 1;26(31):5067–73.
<https://doi.org/10.1200/JCO.2008.16.3071>
PMid: 18794546
 56. Francis ML, Scaife SL, Zahnd WE. Rural-urban differences in surgical procedures for Medicare beneficiaries. *Arch Surg*. 2011 May;146(5):579–83.
<https://doi.org/10.1001/archsurg.2010.306>
PMid: 21242423
 57. Indes JE, Mandawat A, Tuggle CT, et al. Endovascular procedures for aorto-iliac occlusive disease are associated with superior short-term clinical and economic outcomes compared with open surgery in the inpatient population. *J Vasc Surg*. 2010 Nov;52(5):1173–9, 1179.e1.
<https://doi.org/10.1016/j.jvs.2010.05.100>
PMid: 20691560
 58. Yong CM, Abnoui F, Asch SM, et al. Socioeconomic inequalities in quality of care and outcomes among patients with acute coronary syndrome in the modern era of drug eluting stents. *J Am Heart Assoc*. 2014 Nov 14;3(6):e001029.

- <https://doi.org/10.1161/JAHA.114.001029>
PMid: 25398888
59. McCall-Hosenfeld JS, Weisman CS. Receipt of preventive counseling among reproductive-aged women in rural and urban communities. *Rural Remote Health*. 2011;11(1):1617.
PMid: 21280972
 60. Bryant AS, Norton ME, Nakagawa S, et al. Variation in women's understanding of prenatal testing. *Obstet Gynecol*. 2015 Jun;125(6):1306–12.
<https://doi.org/10.1097/AOG.0000000000000843>
PMid: 26000501
 61. Breitkopf CR, Egginton JS, Naessens JM, et al. Who is counseled to lose weight? survey results and anthropometric data from 3,149 lower socioeconomic women. *J Community Health*. 2012 Feb;37(1):202–7.
<https://doi.org/10.1007/s10900-011-9437-8>
PMid: 21744160
 62. Higgins AY, Doubeni AR, Phillips KL, et al. Self-reported colorectal cancer screening of Medicare beneficiaries in family medicine vs. internal medicine practices in the United States: a cross-sectional study. *BMC Gastroenterol*. 2012 Mar 21;12:23.
<https://doi.org/10.1186/1471-230X-12-23>
Pmid: 22436107
 63. Agarwal S, Garg A, Parashar A, et al. Outcomes and resource utilization in ST-elevation myocardial infarction in the United States: evidence for socioeconomic disparities. *J Am Heart Assoc*. 2014 Nov 16;3(6):e001057.
<https://doi.org/10.1161/JAHA.114.001057>
PMid: 25399775
 64. Reames BN, Birkmeyer NJ, Dimick JB, et al. Socioeconomic disparities in mortality after cancer surgery: failure to rescue. *JAMA Surg*. 2014 May;149(5):475–81.
<https://doi.org/10.1001/jamasurg.2013.5076>
PMid: 24623106
 65. Dobalian A. Advance care planning documents in nursing facilities: results from a nationally representative survey. *Arch Gerontol Geriatr*. 2006 Sep–Oct;43(2):193–212.
<https://doi.org/10.1016/j.archger.2005.10.007>
PMid: 16325939
 66. Donaldson EA, Holtgrave DR, Duffin RA, et al. Patient navigation for breast and colorectal cancer in 3 community hospital settings: an economic evaluation. *Cancer*. 2012 Oct 1;118(19):4851–9.
<https://doi.org/10.1002/cncr.27487>
PMid: 22392629
 67. Davis RG, Ressler KJ, Schwartz AC, et al. Treatment barriers for low-income, urban African Americans with undiagnosed posttraumatic stress disorder. *J Trauma Stress*. 2008 Apr;21(2):218–22.
<https://doi.org/10.1002/jts.20313>
PMid: 18404649
 68. Kendrick J, Nuccio E, Leiferman JA, et al. Primary care providers perceptions of racial/ethnic and socioeconomic disparities in hypertension control. *Am J Hypertens*. 2015 Sep;28(9):1091–7.
<https://doi.org/10.1093/ajh/hpu294>
PMid: 25631381

69. Browne JA, Novicoff WM, D'Apuzzo MR. Medicaid payer status is associated with in-hospital morbidity and resource utilization following primary total joint arthroplasty. *J Bone Joint Surg Am.* 2014 Nov 5;96(21):e180.
<https://doi.org/10.2106/JBJS.N.00133>
PMid: 25378513
70. Hanchate AD, Schwamm LH, Huang W, et al. Comparison of ischemic stroke outcomes and patient and hospital characteristics by race/ethnicity and socioeconomic status. *Stroke.* 2013 Feb;44(2):469–76.
<https://doi.org/10.1161/STROKEAHA.112.669341>
PMid: 23306327
71. Trachtenberg AJ, Dik N, Chateau D, et al. Inequities in ambulatory care and the relationship between socioeconomic status and respiratory hospitalizations: a population-based study of a Canadian city. *Ann Fam Med.* 2014 Sep–Oct;12(5):402–7.
<https://doi.org/10.1370/afm.1683>
PMid: 25354403
72. Blackwell DL, Martinez ME, Gentleman JF, et al. Socioeconomic status and utilization of health care services in Canada and the United States: findings from a binational health survey. *Med Care.* 2009 Nov;47(11):1136–46.
<https://doi.org/10.1097/MLR.0b013e3181adcbe9>
PMid: 19786920
73. Mather JF, Fortunato GJ, Ash JL, et al. Prediction of pneumonia 30-day readmissions: a single-center attempt to increase model performance. *Respir Care.* 2014 Feb;59(2):199–208.
<https://doi.org/10.4187/respcare.02563>
PMid: 23942750
74. Tsai TC, Orav EJ, Joynt KE. Disparities in surgical 30-day readmission rates for Medicare beneficiaries by race and site of care. *Ann Surg.* 2014 Jun;259(6):1086–90.
<https://doi.org/10.1097/SLA.0000000000000326>
PMid : 24441810
75. Delgado MK, Yokell MA, Staudenmayer KL, et al. Factors associated with the disposition of severely injured patients initially seen at non-trauma center emergency departments: disparities by insurance status. *JAMA Surg.* 2014 May;149(5):422–30.
<https://doi.org/10.1001/jamasurg.2013.4398>
PMid: 24554059
Erratum in: *JAMA Surg.* 2014 Jun;149(6):543.
76. Erickson KF, Tan KB, Winkelmayer WC, et al. Variation in nephrologist visits to patients on hemodialysis across dialysis facilities and geographic locations. *Clin J Am Soc Nephrol.* 2013 Jun;8(6):987–94.
<https://doi.org/10.2215/CJN.10171012>
PMid: 23430207
77. Henry AJ, Hevelone ND, Hawkins AT, et al. Factors predicting resource utilization and survival after major amputation. *J Vasc Surg.* 2013 Mar;57(3):784–90.
<https://doi.org/10.1016/j.jvs.2012.09.035>
PMid: 23312839
78. Cheung PT, Wiler JL, Lowe RA, et al. National study of barriers to timely primary care and emergency department utilization among Medicaid beneficiaries. *Ann Emerg Med.* 2012 Jul;60(1):4–10.e2.
<https://doi.org/10.1016/j.annemergmed.2012.01.035>
PMid: 22418570

79. Rogowski J, Freedman VA, Wickstrom SL, et al. Socioeconomic disparities in medical provider visits among Medicare managed care enrollees. *Inquiry*. 2008 Spring;45(1):112–29.
<https://doi.org/10.5034/inquiryjml.45.01.112>
PMid: 18524296
80. Jaja BN, Saposnik G, Nisenbaum R, et al. Effect of socioeconomic status on inpatient mortality and use of postacute care after subarachnoid hemorrhage. *Stroke*. 2013 Oct;44(10):2842–7.
<https://doi.org/10.1161/STROKEAHA.113.001368>
PMid: 23899917
81. LaPar DJ, Bhamidipati CM, Harris DA, et al. Gender, race, and socioeconomic status affects outcomes after lung cancer resections in the United States. *Ann Thorac Surg*. 2011 Aug;92(2):434–9.
<https://doi.org/10.1016/j.athoracsur.2011.04.048>
PMid: 21704976
82. Melvan JN, Sancheti MS, Gillespie T, et al. Nonclinical factors associated with 30-day mortality after lung cancer resection: an analysis of 215,000 patients using the national cancer data base. *J Am Coll Surg*. 2015 Aug;221(2):550–63.
<https://doi.org/10.1016/j.jamcollsurg.2015.03.056>
PMid: 26206651
83. Nee R, Martinez-Osorio J, Yuan CM, et al. Survival disparity of African American versus Non-African American patients with ESRD due to SLE. *Am J Kidney Dis*. 2015 Oct;66(4):630–7.
<https://doi.org/10.1053/j.ajkd.2015.04.011>
PMid: 26002293
84. Osborne NH, Upchurch GR Jr, Mathur AK, et al. Explaining racial disparities in mortality after abdominal aortic aneurysm repair. *J Vasc Surg*. 2009 Oct;50(4):709–13.
<https://doi.org/10.1016/j.jvs.2009.05.020>
PMid: 19703760
85. Polanco A, Breglio AM, Itagaki S, et al. Does payer status impact clinical outcomes after cardiac surgery? a propensity analysis. *Heart Surg Forum*. 2012 Oct;15(5):E262–7.
<https://doi.org/10.1532/HSF98.20111163>
PMid: 23092662
86. Saposnik G, Cote R, Phillips S, et al. Stroke outcome in those over 80: a multicenter cohort study across Canada. *Stroke*. 2008 Aug;39(8):2310–7.
<https://doi.org/10.1161/STROKEAHA.107.511402>
PMid: 18556583
87. Barton JL, Trupin L, Schillinger D, et al. Racial and ethnic disparities in disease activity and function among persons with rheumatoid arthritis from university-affiliated clinics. *Arthritis Care Res (Hoboken)*. 2011 Sep;63(9):1238–46.
<https://doi.org/10.1002/acr.20525>
PMid: 21671414
88. Sun CL, Francisco L, Baker KS, et al. Adverse psychological outcomes in long-term survivors of hematopoietic cell transplantation: a report from the Bone Marrow Transplant Survivor Study (BMTSS). *Blood*. 2011 Oct 27;118(17):4723–31.
<https://doi.org/10.1182/blood-2011-04-348730>
PMid: 21821714
89. Gilman SE, Fitzmaurice GM, Bruce ML, et al. Economic inequalities in the effective-

- ness of a primary care intervention for depression and suicidal ideation. *Epidemiology*. 2013 Jan;24(1):14–22.
<https://doi.org/10.1097/EDE.0b013e3182762403>
Pmid: 23232609
90. Bastani R, Mojica CM, Berman BA, et al. Low-income women with abnormal breast findings: results of a randomized trial to increase rates of diagnostic resolution. *Cancer Epidemiol Biomarkers Prev*. 2010 Aug;19(8):1927–36.
<https://doi.org/10.1158/1055-9965.EPI-09-0481>
PMid: 20647406
 91. Walker EA, Schechter CB, Caban A, et al. Telephone intervention to promote diabetic retinopathy screening among the urban poor. *Am J Prev Med*. 2008 Mar;34(3):185–91.
<https://doi.org/10.1016/j.amepre.2007.11.020>
PMid: 18312805
 92. Ralston JD, Silverberg MJ, Grothaus L, et al. Use of web-based shared medical records among patients with HIV. *Am J Manag Care*. 2013 Apr 1;19(4):e114–24.
PMid: 23725449
 93. Heisler M, Choi H, Palmisano G, et al. An LC. Comparison of community health worker-led diabetes medication decision-making support for low-income Latino and African American adults with diabetes using e-health tools versus print materials: a randomized, controlled trial. *Ann Intern Med*. 2014 Nov 18;161(10 Suppl):S13–22.
<https://doi.org/10.7326/M13-3012>
PMid: 25402398
 94. Levy N, Moynihan V, Nilo A, et al. The Mobile Insulin Titration Intervention (MITI) for insulin adjustment in an urban, low-income population: randomized controlled trial. *J Med Internet Res*. 2015 Jul 17;17(7):e180.
<https://doi.org/10.2196/jmir.4716>
PMid: 26187303
 95. Ell K, Aranda MP, Xie B, et al. Collaborative depression treatment in older and younger adults with physical illness: pooled comparative analysis of three randomized clinical trials. *Am J Geriatr Psychiatry*. 2010 Jun;18(6):520–30.
<https://doi.org/10.1097/JGP.0b013e3181cc0350>
PMid: 20220588
 96. Miller SM, Hui SK, Wen KY, et al. Tailored telephone counseling to improve adherence to follow-up regimens after an abnormal pap smear among minority, underserved women. *Patient Educ Couns*. 2013 Dec;93(3):488–95.
<https://doi.org/10.1016/j.pec.2013.08.008>
PMid: 24007767
 97. Gabitova G, Burke NJ. Improving health care empowerment through breast cancer patient navigation: a mixed methods evaluation in a safety-net setting. *BMC Health Serv Res*. 2014 Sep 19;14:407.
<https://doi.org/10.1186/1472-6963-14-407>
PMid: 25234963
 98. Shah R, Franks P, Jerant A, et al. The effect of targeted and tailored patient depression engagement interventions on patient-physician discussion of suicidal thoughts: a randomized control trial. *J Gen Intern Med*. 2014 Aug;29(8):1148–54.
<https://doi.org/10.1007/s11606-014-2843-8>
PMid: 24710994
 99. Ogedegbe G, Tobin JN, Fernandez S, et al. Counseling African Americans to control

- hypertension: cluster-randomized clinical trial main effects. *Circulation*. 2014 May 20;129(20):2044–51.
<https://doi.org/10.1161/CIRCULATIONAHA.113.006650>
PMid : 24657991
100. Berra K, Ma J, Klieman L, et al. Implementing cardiac risk-factor case management: lessons learned in a county health system. *Crit Pathw Cardiol*. 2007 Dec;6(4):173–9.
PMid: 18091408
 101. Wright K, Hazelett S, Jarjoura D, et al. The AD-LIFE Trial: working to integrate medical and psychosocial care management models. *Home Health care Nurse*. 2007 May;25(5):308–314.
<https://doi.org/10.1097/01.NHH.0000269964.34045.d5>
PMid: 17495560
 102. Jones K, Gould MI, Duncan C. Death and deprivation: an exploratory analysis of deaths in the health and lifestyle survey. *Soc Sci Med*. 2000 Apr;50(7–8):1059–79.
[https://doi.org/10.1016/S0277-9536\(99\)00355-X](https://doi.org/10.1016/S0277-9536(99)00355-X)
PMid: 10714927
 103. Pickett KE, Pearl M. Multilevel analyses of neighbourhood socioeconomic context and health outcomes: a critical review. *J Epidemiol Community Health*. 2001 Feb; 55(2):111–22.
<https://doi.org/10.1136/jech.55.2.111>
PMid: 11154250
 104. Lochner KA, Kowachi I, Brennan RT, et al. Social capital and neighborhood mortality rates in Chicago. *Soci Sci Med*. 2003 Apr; 56(8):1797–805.
[https://doi.org/10.1016/S0277-9536\(02\)00177-6](https://doi.org/10.1016/S0277-9536(02)00177-6)
PMid: 12639596
 105. Ross CE, Mirowsky J. Neighborhood socioeconomic status and health: context or composition? *City Community* 2008 Jun;7(2):163–79.
<https://doi.org/10.1111/j.1540-6040.2008.00251.x>
 106. Macintyre S, Ellaway A, Cummins S. Place effects on health: how can we conceptualise, operationalise and measure them? *Soc Sci Med* 2002 Jul; 55(1):125–39.
[https://doi.org/10.1016/S0277-9536\(01\)00214-3](https://doi.org/10.1016/S0277-9536(01)00214-3)
PMid: 12137182
 107. Stafford M, McCarthy M. Neighborhoods, housing and health. In: Marmot M, Wilkinson RG, eds. *Social determinants of health*, 2nd ed. United Kingdom: Oxford University Press, 2006.
 108. Keita S, Kittles RA, Royal CD, et al. Conceptualizing human variation. *Nat Genet*. 2004 Nov;36(11 Suppl):S17–20.
<https://doi.org/10.1038/ng1455>. PMID 15507998
PMid: 15507998
 109. Case A, Deaton A. Rising morbidity and mortality in midlife among white non-hispanic Americans in the 21st century. *Proc Natl Acad Sci USA*. 2015 Dec 8; 112(49):15078–83.
<https://doi.org/10.1073/pnas.1518393112>
PMid: 26575631
 110. PEW Research Center. *Racial, gender wage gap persists in US despite progress*. Washington, DC: PEW Research Center; 2016. Available at: <http://www.pewresearch.org/fact-tank/2016/07/01/racial-gender-wage-gaps-persist-in-u-s-despite-some-progress/>.
 111. Centers for Medicare and Medicaid Services. *List of Medicaid eligibility groups*.

- Baltimore, MD: US Department of Health and Human Services, 2016. Available at: <https://www.medicaid.gov/medicaid-chip-program-information/by-topics/waivers/1115/downloads/list-of-eligibility-groups.pdf>
112. Braveman PA, Cubbin C, Egerter S, Chideya S, Marchi KS, Metzler M, et al. Socioeconomic status in health research: one size does not fit all. *JAMA*. 2005 Dec 14;294(22):2879–88.
<https://doi.org/10.1001/jama.294.22.2879>
PMid: 16352796
 113. Shavers VL. Measurement of socioeconomic status in health disparities research. *J Natl Med Assoc*. 2007 Sep;99(9):1013–23.
PMid: 17913111
 114. Townsend P, Phillimore P, Beattie A. Health and deprivation: inequality and the North. London, UK: Routledge, 1988.
 115. Galster GC. 2012. The mechanism (s) of neighbourhood effects: theory, evidence, and policy implications. In: *Neighbourhood effects research: new perspectives*. London, UK: Springer, 2012; pp. 23–56.
<https://doi.org/10.1007/978-94-007-2309-2>
 116. Krieger N, Chen JT, Waterman PD, Soobader MJ, Subramanian SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: Does the choice of area-based measure and geographic level matter?: The public health disparities geocoding project. *Am J Epidemiol*. 2002 Sep 1;156(5):471–82.
<https://doi.org/10.1093/aje/kwf068>
PMid: 12196317
 117. May C, Montori VM, Mair F. We need minimally disruptive medicine. *BMJ*. 2009 Aug 11; 339:b2803.
<https://doi.org/10.1136/bmj.b2803>
PMid: 19671932
 118. English KC, Merzel C, Moon-Howard J. Translating public health knowledge into practice: development of a lay health advisor perinatal tobacco cessation program. *J Public Health Manag Pract*. 2010 May–Jun;16(3):E9–19.
<https://doi.org/10.1097/PHH.0b013e3181af6387>
PMid: 20357602
 119. Shaw M, Dorling D, Smith GD. Poverty, social exclusion and minorities. In: Marmot M, Wilkinson RG, eds. *Social Determinants of Health*, 2nd Ed. United Kingdom: Oxford University Press, 2006.
 120. Reinhard SC, Levine C, Samis S. Home alone: family caregivers providing complex chronic care. Washington, DC: AARP Public Policy Institute, 2012. Available at: https://www.aarp.org/content/dam/aarp/research/public_policy_institute/health/home-alone-family-caregivers-providing-complex-chronic-care-rev-AARP-ppi-health.pdf.
 121. Stansfield SA. Social support and social cohesion. In: Marmot M, Wilkinson RG, editors. *Social Determinants of Health*, 2nd edi. United Kingdom: Oxford University Press, 2006.
 122. Rainie L, Zickuhr K. Americans' views on mobile etiquette. Washington, DC: Pew Research Center, 2015 Aug. Available at: <http://www.pewinternet.org/2015/08/26/americans-views-on-mobile-etiquette/>